AMBIENT AIR QUALITY DURING THE PRE START UP PERIOD OF THE VICTORIA HOSPITAL ENERGY FROM WASTE PLANT

Technical Support Section
Southwestern Region

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TABLE OF CONTENTS

		PAGE
SUMMARY		1
INTRODUCTION		2
DESCRIPTION OF MONITORING NETWORK		2
MONITORING AND PROGRAM RESULTS		7
Dustfall		7
Total Suspended Particulate Matter		8
Experimental Comparison Program		10
Sulphur Dioxide		12
CONCLUSIONS		13
APPENDIX 1	Criteria for Desirable Ambient Air Quality	14
APPENDIX 2	Dustfall Data	16
APPENDIX 3	Data for Total Suspended Particulates	18

SUMMARY

In May 1986, approximately one year prior to the scheduled start up of the Energy From Waste Plant of the Victoria Hospital Corporation of London, the Ministry of the Environment commenced ambient air quality monitoring at four fixed sites. The monitoring program consisted of continuous sulphur dioxide monitoring at three sites and dustfall and total suspended particulate sampling at four sites. The dustfall and total particulate samples were analyzed for a number of metal constituents.

The analytical results of the monitoring program were very low for 1986. The monitoring program will be continued for at least two years after the start up of the EFW plant.

RÉSUMÉ

En mai 1986, environ un an avant l'ouverture prévue de l'usine de transformation des déchets en énergie de la Victoria Hospital Corporation de London, le Ministère a commencé à surveiller l'air ambiant à quatre emplacements fixes. Les substances recherchées étaient le bioxyde de soufre, les poussières et les particules en suspension ainsi que divers éléments de ces deux dernières substances. Les résultats de l'analyse de 1986 ont révélé des concentrations très basses. Le contrôle se poursuivra pendant au moins deux ans après la mise en opération de l'usine de transformation des déchets.

INTRODUCTION

In accordance with the terms and conditions of approval to proceed with the Energy From Waste (EFW) facility for The Victoria Hospital Corporation of London, the Ministry established four fixed ambient air monitoring stations. Air monitoring at the stations began in May 1986 which was approximately one year prior to the scheduled start up of the EFW facility.

In addition to the fixed ambient air monitoring sites, which are the subject of this report, the Ministry has also conducted pre-operational air monitoring surveys using mobile monitoring vans and phytotoxicology studies. Reports have been released on these surveys and after the EFW facility becomes operational more studies will be conducted.

DESCRIPTION OF MONITORING NETWORK

The four fixed ambient air monitoring stations are equipped with samplers to collect dustfall and total suspended particulate matter. In addition three of the sites have continuous sulphur dioxide gas monitors. The locations of the monitoring stations are shown on Figure 1. Table 1 contains a description of the monitoring sites and the monitoring equipment. The four locations are in the vicinity of areas described in the Environmental Assessment hearings as being sensitive or having the greatest potential for experiencing the greatest impact from the emissions of the EFW plant.

Air monitoring station 15014 is located on the roof of a Public Utilities Commission hydro station at the corner of Pond Mills Road and Deveron Crescent. This site is approximately 1.8 km east southeast of the EFW facility. The station is equipped

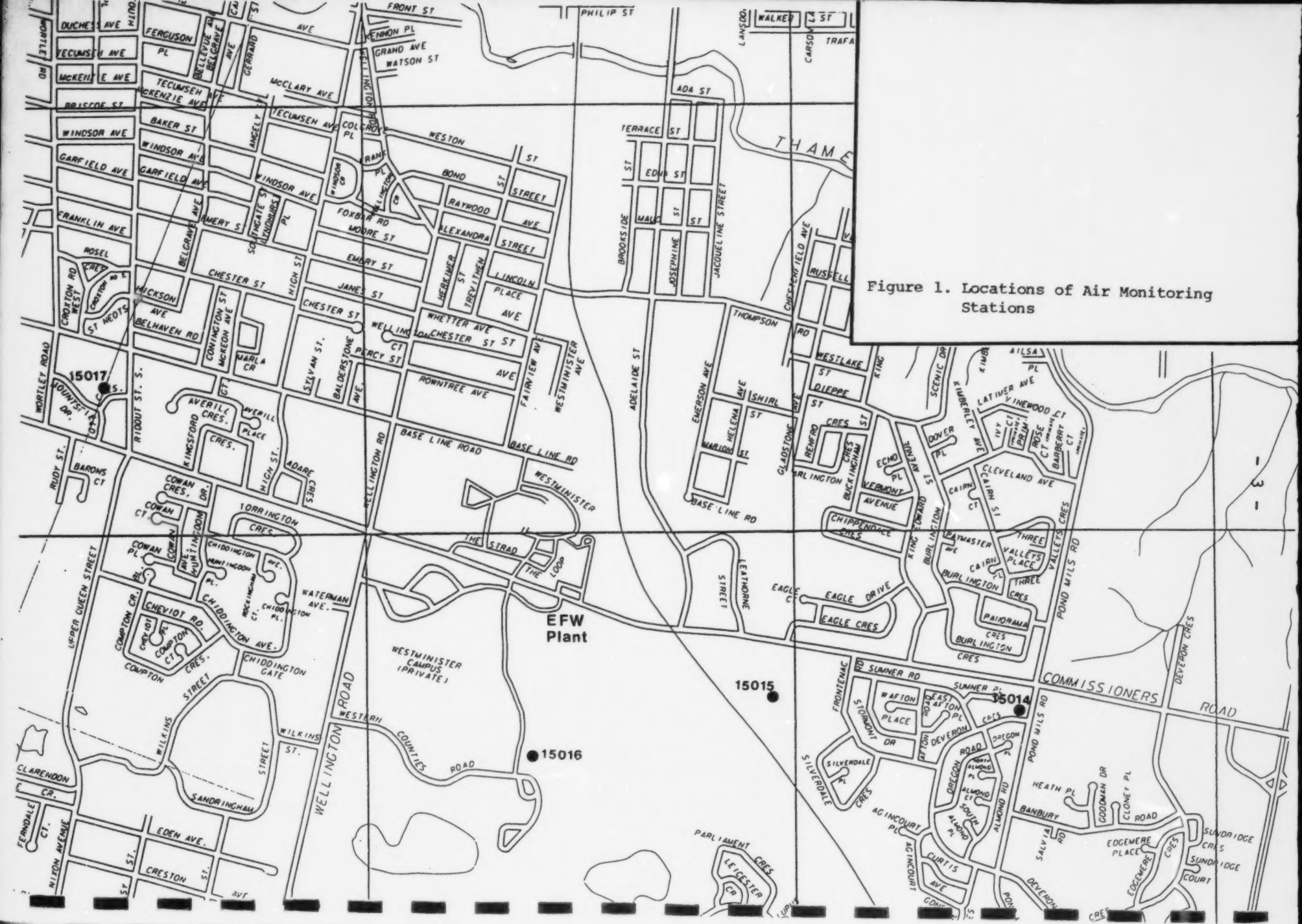

Figure 1. Locations of Air Monitoring Stations

Table 1. Monitoring Station Description

Station Number	Location	Air Intake	Equipment
15014	Corner of Pond Mills Road and and Deveron Crescent on roof of PUC hydro station	4 metres above ground level	Dustfall jar High volume total suspended particulate sampler
15015	951 Commissioners Road East west of Bristol Towers apartments	4 metres above ground level	Dustfall jar High volume total suspended particulate sampler Continuous sulphur dioxide monitor
15016	801 Commissioners Road East southeast of Parkwood Hospital adjacent to barracks	4 metres above ground level	Dustfall jar High volume total suspended particulate sampler Continuous sulphur dioxide monitor
15017	8 Mountsfield Drive on roof of Mountsfield Public School	6 metres above ground level	Dustfall jar High volume total suspended particulate sampler Continuous sulphur dioxide monitor

with a dustfall sampler and a total suspended particulate sampler, both of which are approximately four metres above ground level.

Station 15015 is located adjacent to the property of Bristol Towers at 951 Commissioners Road East. The station is approximately 1 km east southeast of the EFW facility. A continuous sulphur dioxide gas analyzer, a dustfall sampler and a total suspended particulate sampler are operated at this station. All air samples are collected at a height of approximately four metres above ground level.

Station 15016 is located on hospital property approximately 0.5 km south of the EFW facility. The station is equipped with sulphur dioxide, dustfall and total suspended particulate monitors and air samples are collected at four metres above ground level.

Station 15017 is located at Mountsfield Public School approximately 1.7 km west northwest of the EFW facility. Sulphur dioxide, dustfall and total suspended particulate monitors are located at this station. Air samples are collected at six metres above ground level.

Dustfall samples are collected over a one month period. Dustfall samples are analyzed for the parameters listed in Table 2.

Total suspended particulate samples are collected over a 24 hour period (midnight to midnight) on an every-sixth-day sampling schedule. The samples are analyzed for the different parameters listed in Table 3. Some parameters that are analyzed for in dustfall samples are not analyzed for in suspended particulate samples because of either losses due to volatilization caused by the high flow rate (40 ft^3/min) used in the total suspended particulate sampling or inaccurate results produced by varying

Table 2 List of Parameters Analyzed for in Dustfall Samples

Total dustfall	arsenic	antimony
beryllium	cadmium	chromium
copper	iron	lead
lithium	manganese	nickel
selenium	tin	titanium
vanadium	zinc	

Table 3 List of Parameters Analyzed for in Total Suspended Particulate Samples

Total suspended particulate matter	iron	manganese
cadmium	chromium	copper
lead	nickel	vanadium
antimony	cobalt	nitrate
sulphate	total carbon	elemental carbon
carbonate carbon		

background levels of the elements occurring in the glass fiber sampling filters used to trap the total suspended particulate matter.

In September 1986 the total suspended particulate samplers at stations 15015 and 15016 were equipped with exhaust venting to prevent contamination of the samples by copper worn from the armatures of the sampling motors. In October exhaust venting was installed at stations 15014 and 15017.

In order to determine the level of some parameters that are not normally analyzed for because of varying levels in the glass fibre filters, five samples of total suspended particulate matter were collected at both station 15015 and 15016 using polyfon filters.

MONITORING AND PROGRAM RESULTS

Dustfall

Ontario's criteria for desirable ambient air quality with respect to dustfall is 7.0 grams of dustfall per square metre in 30 days (gm/m^2/30 days) and 4.6 gm/m^2/30 days averaged for one year. These criteria are in keeping with other control agencies and are based more on historical information that on adverse effects. The criteria for desirable ambient air quality are listed in Table A1, Appendix 1.

There were numerous problems encountered by the dustfall monitoring program. Many of the p. blems were a result of being unable to adequately accommodate some of the analyses for different parameters in the dustfall. Parameters such as lithium, beryllium, titanium, tin and antimony are not normally analyzed for in dustfall samples. Laboratory staff developed

tentative analytical methods for these parameters. However, the logistics of having the non-routine parameters analyzed were not properly resolved until 1987. Also, a major change in laboratory staffing resulted in some communication problems that led to some parameters not being analyzed. As a result of these difficulties there are no total dustfall results available for June and August. The results for September include only dustfall and no metals.

The available 1986 dustfall data reveal very low levels of total dustfall and metals. Many of the metals are below the detection limits of the analytical procedures and the total dustfall values are well below the 30 day criterion. The dustfall data appear in Table A2 of Appendix 2.

Total Suspended Particulate Matter

Ontario has criteria for desirable ambient air quality with respect to total suspended particulate matter. The criterion for 24 hours is 120 micrograms of suspended particulates per cubic metre of air (ug/m^3) and there is an annual criterion of 60 ug/m^3 expressed as an annual geometric mean.

The first total suspended particulate matter samples were collected from the monitoring stations in the vicinity of the EFW facility on May 26, 1986. There were no values at any of the four sites above the 24-hour criterion during the period of May 26 to December 31, 1986 based on the every-sixth-day sampling schedule. During the same period there were no values above the 24-hour criterion for samples collected at station 15001, located at the Western Fairgrounds.

Although not representative of the entire year, the annual geometric mean values calculated for the four monitoring stations near the EFW facility were below the annual criterion of 60

ug/m^3. The annual geometric mean for station 15001 at the Western Fairgrounds is 49 ug/m^3 compared to values of 43, 35, 37 and 41 ug/m^3 for stations 15014, 15015, 15016 and 15017 respectively. Lower average values at stations 15015 and 15016 may be attributable to these stations being more remote from emissions from heavily travelled roads.

The total suspended particulate samples are normally collected on glass fibre filters and analyzed for the parameters listed in Table 3. The glass fibre filters have a tendency to collect sulphate and nitrate artifact by converting gases to particulate matter. This results in erroneously higher values of total suspended particulate matter being reported. The Ministry is evaluating a polyfon filter as a possible replacement for the glass fibre filter and some tests conducted in connection with this program are discussed later in this report.

Most of the parameters analyzed for in the total suspended particulate samples are found at very low levels with many results being below the detection level of the analytical method. The parameters that appear in the highest concentrations are total carbon, sulphate and nitrates. Total carbon is made up of elemental carbon, which would be coal, soot and graphite, inorganic carbon in carbonate form and organic carbon. Since the levels of elemental and carbonate carbon are low, most of the total carbon is organic carbon. Much of the organic carbon would be from vegetation and would include pollen.

Criteria for desirable ambient air quality exist for cadmium, lead, nickel and vanadium. These criteria are listed in Table A1, Appendix 1 and published in Regulation 296. In addition, there are criteria for desirable ambient air quality pertaining to parameters not included in Regulation 296. Some of the criteria are tentative or provisional because additional

scientific information is required, however these criteria are also listed in Table A1. There are some parameters for which criteria have not been established. All values measured in 1986 near the proposed EFW plant were less than the criteria.

The analytical data for the samples collected in 1986 appear in Table A3 of Appendix 3.

Experimental Comparison Program

Previously, disadvantages with using glass fibre filters to collect suspended particulate samples were discussed. Polyfon filters, which the Ministry is evaluating, can be analyzed for more parameters than the glass fibre filters and the polyfon filters collect much less sulphate and nitrate artifact.

For a brief trial period at both stations 15015 and 15016 total suspended particulate samples were collected simultaneously using glass fibre and polyfon filters. The data obtained from the simultaneously exposed filters appear in Tables A4 and A5 of Appendix 3.

The analytical results indicate very low levels of metallic components in the suspended particulate samples collected by both types of filters. Of special interest are the low levels of lithium, beryllium and tin collected by the polyfon filters since these parameters are not analyzed for when glass fibre filters are used.

The values for total suspended particulates collected by the two different filter media are reasonably comparable except for samples collected at station 15016 on September 23, 1986. The discrepancy between the results for September 23 is attributable largely to sulphate artifact collected on the glass fibre filter.

CONCLUSIONS

The 1986 monitoring program demonstrated that levels of dustfall, total suspended particulate matter and sulphur dioxide were low in the vicinity of the EFW facility being constructed by The Victoria Hospital Corporation of London. In addition, the parameters measured in the samples of dustfall and total suspended particulate matter were low.

Data for dustfall and parameters in dustfall were lost because of poor communication and changes at the Ministry laboratory and because of the atypical nature of the parameters being requested requiring special analytical procedures. The Ministry should improve the percentage of valid data for dustfall samples in 1987.

The monitoring program will be continued for at least two years after the start up of the EFW plant.

During 1987 both glass fibre and polyfon filters have been used on a regular basis simultaneously at station 15016. The Ministry is investigating the arrangements that must be made to switch from glass fibre to polyfon filters. One aspect that is creating a difficulty is obtaining an assurance that the filter manufacturer can meet the supply demand of the Ministry.

Sulphur Dioxide

Combustion of sulphur containing fuels comprises the predominant source of man made emissions of sulphur oxides. Sulphur in the refuse to be burned at the Energy from Waste plant will be a source of sulphur dioxide.

The criteria for desirable ambient air quality with respect to sulphur dioxide are 0.25 parts of sulphur dioxide per million parts of air (ppm) averaged for one hour, 0.10 ppm averaged for 24 hours (midnight to midnight) and 0.02 ppm as an annual average. The one-hour and annual criteria were established for the protection of vegetation while the 24-hour criterion serves to protect human health.

These criteria were not exceeded at the three monitoring sites with the SO_2 monitors near the EFW Plant nor at the monitoring station located at the Western Fairgrounds. A summary of the SO_2 data appears in Table 4. It is apparent that SO_2 levels were very low in 1986.

Table 4: Summary of Sulphur Dioxide Data for 1986

	Total No. of 1 Hour Values	No. of Values Greater Than 1 Hr. Criterion	No. of Values Greater Than 24 Hr. Criterion	Annual Average (ppm)	Maximum 1 Hour Value (ppm)	Maximum 24 Hour Value (ppm)
Station 15015 Bristol Towers	4075	0	0	0.002	0.04	0.01
Station 15016 Hospital Property	3803	0	0	0.003	0.08	0.03
Station 15017 Mountsfield P.S.	5271	0	0	0.001	0.03	0.02
Station 15001 Western Fairgrounds	8129	0	0	0.003	0.08	0.02

APPENDIX 1

CRITERIA FOR DESIRABLE AMBIENT AIR QUALITY

Table A1 Criteria for Desirable Ambient Air Quality

Name of Contaminant	Average Amount of Concentration (ug/m^3)	Period of Time	Comment
Cadmium	2	24 hours	Regulation 296
Lead	5	24 hours	Regulation 296
	2 (geometric mean)	30 days	Regulation 296
	3 (arithmetic mean)	30 days	
Nickel	2	24 hours	Regulation 296
Vanadium	2	24 hours	Regulation 296
Chromium	10	24 hours	
Copper	50	24 hours	
Manganese	50	24 hours	
Iron (Metallic)	4	24 hours	
Selenium	10	24 hours	Guideline
Tin	10	24 hours	
Titanium	100	24 hours	
Zinc	100	24 hours	
Total Suspended Particulates	120	24 hours	Regulation 296
	60	Annual geometric mean	Regulation 296
Dustfall	7.0 gm/m^2/30 days	30 days	Regulation 296
Dustfall	4.6 gm/m^2/30 days	1 year	Regulation 296
Sulphur dioxide	0.25 ppm	1 hour	Regulation 296
	0.10 ppm	24 hours	Regulation 296
	0.02 ppm	1 year	Regulation 296

APPENDIX 2

DUSTFALL DATA

Table A2 Monthly Results for Dustfall Samples (g/m^2/30 days)

Parameter	Station 15014					Station 15015				
	July 86	Sept 86	Oct 86	Nov 86	Dec 86	July 86	Sept 86	Oct 86	Nov 86	Dec 86
Total Dustfall	1.9	1.9	1.5	1.9	1.0	2.6	0.6	1.8	0.4	4.2
Antimony	<0.01		<0.000	<0.000	<0.000	<0.01		<0.000	<0.000	<0.000
Arsenic			<0.000	<0.000	<0.000			<0.000	<0.000	<0.000
Beryllium	<0.000		<0.000	<0.000	<0.000	<0.000		<0.000	<0.000	<0.000
Cadmium	<0.000		<0.000	<0.000	<0.000	<0.000		<0.000	<0.000	<0.000
Chromium	<0.000		<0.000	<0.000	<0.000	<0.000		<0.000	<0.000	<0.000
Copper	0.001		0.001	0.001	0.001	<0.000		0.001	<0.000	<0.000
Iron	0.003		0.002	0.001	0.001	0.001		0.002	0.001	0.002
Lead	0.001		0.001	<0.001	<0.001	0.000		<0.000	<0.000	<0.000
Lithium	<0.000					<0.000				
Manganese	<0.000		<0.000	<0.000	<0.000	<0.000		<0.000	<0.000	<0.000
Nickel	<0.000		<0.000	<0.000	<0.000	<0.000		<0.000	<0.000	<0.000
Selenium	<0.01		<0.000	<0.000	<0.000	<0.01		<0.000	<0.000	<0.000
Tin	<0.000					<0.000				
Titanium	<0.000		<0.000	<0.000		<0.000		<0.000	<0.000	
Vanadium	<0.000		<0.000	<0.000	<0.000	<0.000		<0.000	<0.000	<0.000
Zinc	0.003		0.002	0.001	<0.001	0.003		0.003	<0.000	<0.000

Parameter	Station 15016					Station 15017				
	July 86	Sept 86	Oct 86	Nov 86	Dec 86	July 86	Sept 86	Oct 86	Nov 86	Dec 86
Total Dustfall	1.2	1.0	1.8	0.7	1.7	1.7	0.5	2.0	1.7	1.2
Antimony	<0.01		<0.000	<0.000	<0.000	<0.01		<0.000	<0.000	<0.000
Arsenic			<0.000	<0.000	<0.000			<0.000	<0.000	<0.000
Beryllium	<0.000		<0.000	<0.000		<0.000		<0.000	<0.000	
Cadmium	<0.000		<0.000	<0.000	<0.000	<0.000		<0.000	<0.000	<0.000
Chromium	<0.000		<0.000	<0.000	<0.000	<0.000		<0.000	<0.000	<0.000
Copper	0.001		0.002	<0.000	<0.000	0.001		0.002	<0.000	<0.000
Iron	0.002		0.002	0.001	0.001	0.004		0.002	0.001	0.001
Lead	<0.001		<0.000	<0.000	<0.000	0.001		<0.000	<0.000	<0.000
Lithium	<0.000					<0.000				
Manganese	<0.000		<0.000	<0.000	<0.000	<0.000		<0.000	<0.000	<0.000
Nickel	<0.000		<0.000	<0.000	<0.000	<0.000		<0.000	<0.000	<0.000
Selenium	<0.01		<0.000	<0.000	<0.000	<0.01		<0.000	<0.000	<0.000
Tin	<0.000					<0.000				
Titanium	<0.000		<0.000	<0.000		<0.001		<0.000	<0.000	
Vanadium	<0.000		<0.000	<0.000	<0.000	<0.000		<0.000	<0.000	<0.000
Zinc	0.002		0.004	0.001	<0.000	0.002		0.003	0.001	<0.000

APPENDIX 3

DATA FOR TOTAL SUSPENDED PARTICULATES

TABLE: A3

STATION 15014 VICTORIA HOSPITAL ENERGY FROM WASTE PLANT

TOTAL SUSPENDED PARTICULATES IN UNITS OF UG/M3

DATE 1986	TOTAL TSP	TOTAL ANTIMONY	TOTAL CADMIUM	TOTAL CARBON	ELEMENTAL CARBON	CARBON CARBONATE	TOTAL CHROMIUM	TOTAL COPPER	TOTAL IRON	TOTAL LEAD	TOTAL MANGANESE	TOTAL NICKEL	TOTAL NITRATES	SULPHATE	TOTAL VANADIUM
26/05	56	0.001	<0.001	6.80	2.00	1.6	0.011	1.21	0.8	0.3	0.035	<0.003	2.9	5.7	0.018
01/06	66	0.001	<0.001	8.10	1.80	0.7	<0.009	0.03	0.8	0.1	0.025	<0.003	4.3	6.6	0.009
19/06	52	0.001	<0.001	4.80	1.20	0.2	0.010	0.02	0.5	0.1	0.016	<0.003	5.9	6.9	0.009
25/06	33	0.001	<0.001	3.70	1.10	0.6	<0.009	0.06	0.4	0.1	<0.010	<0.003	1.6	3.7	<0.009
01/07	48	0.001	<0.001	5.90	1.00	0.2	<0.009	0.08	0.7	0.2	0.011	<0.003	5.1	8.6	0.017
07/07	76	0.001	<0.001	7.00	0.70	0.3	<0.009	0.03	2.5	0.1	0.029	<0.003	4.6	10.9	0.020
13/07	32	0.001	<0.001	4.50	1.00	<0.1	<0.009	0.04	<0.2	<0.1	<0.010	<0.003	3.6	6.3	0.009
19/07	44	0.001	<0.001	5.40	0.50	<0.1	<0.009	0.04	0.3	0.1	0.014	<0.003	4.7	8.3	<0.009
25/07	68	0.001	<0.001	5.80	0.80	0.5	<0.009	0.02	0.5	0.1	0.015	<0.003	2.0	22.1	<0.009
31/07	36	0.001	<0.001	6.80	1.00	<0.1	<0.009	0.06	0.4	0.3	0.011	<0.003	2.1	4.1	0.012
06/08	67	0.001	<0.001	9.60	2.40	0.3	<0.009	0.05	0.8	0.1	0.018	<0.003	7.4	12.4	<0.009
12/08	46	0.001	<0.001	7.30	1.80	0.9	0.010	0.06	0.7	0.1	0.033	<0.003	2.1	5.4	<0.009
18/08	45	0.001	<0.001	7.80	1.30	0.9	<0.009	0.06	0.5	0.2	0.018	<0.003	1.7	4.7	<0.009
24/08	22	<0.001	<0.001	4.20	0.40	0.2	<0.009	0.01	<0.2	0.1	<0.010	<0.003	1.1	3.1	<0.009
30/08	48	0.001	<0.001	6.50	3.10	0.3	<0.009	0.05	0.6	0.1	0.019	<0.003	5.1	7.9	<0.009
05/09	40	0.001	<0.001	7.00	0.60	0.5	<0.009	0.04	0.4	0.1	0.011	<0.003	2.0	4.3	0.012
11/09	31	0.001	<0.001	4.20	0.60	<0.1	<0.009	<.01	<0.2	<0.1	<0.010	<0.003	2.1	11.9	<0.009
17/09	43	0.001	<0.001	5.80	1.50	0.8	<0.009	0.07	0.5	0.2	0.020	<0.003	1.9	7.4	0.013
23/09	29	0.001	<0.001	5.10	1.70	0.1	<0.009	0.04	0.2	0.2	0.013	<0.003	1.9	6.3	<0.009
29/09	39	0.001	<0.001	6.80	1.00	<0.1	<0.009	0.03	<0.2	0.2	<0.010	<0.003	4.0	10.6	<0.009
05/10	23	<0.001	<0.001	2.40	0.20	<0.1	<0.009	0.03	<0.2	<0.1	<0.010	<0.003	0.9	4.3	<0.009
11/10	46	0.001	<0.001	5.30	1.80	0.3	<0.009	0.06	0.6	0.2	0.029	<0.003	2.9	4.9	<0.009
17/10	41	0.001	<0.001	12.70	2.60	0.3	<0.009	0.08	1.8	0.7	0.100	<0.003	4.6	4.9	<0.009
23/10	55	0.001	<0.001	5.80	1.30	0.3	<0.009	0.04	1.8	0.1	0.030	<0.003	4.9	8.0	<0.009
29/10	43	0.001	<0.001	3.80	0.80	<0.1	<0.009	0.01	<0.2	0.1	0.018	<0.003	4.3	7.4	<0.009
04/11	71	0.001	<0.001	6.20	0.80	2.1	<0.009	0.04	0.8	0.4	0.036	<0.003	2.0	7.3	<0.009
10/11	38	0.001	<0.001	4.30	0.40	0.4	<0.009	0.03	0.3	0.2	0.012	<0.003	1.7	5.4	<0.009
16/11	47	0.001	<0.001	4.00	0.40	<0.1	<0.009	0.01	0.3	0.1	<0.010	<0.003	7.1	11.1	<0.009
22/11	37	0.001	<0.001	4.20	0.50	<0.1	<0.009	0.02	<0.2	0.2	<0.010	<0.003	7.7	10.3	<0.009
04/12	20	<0.001	<0.001	1.40	0.40	<0.1	<0.009	<.01	<0.2	<0.1	<0.010	<0.003	2.3	8.6	<0.009
10/12	38	<0.001	<0.001	3.90	1.90	0.4	<0.009	<.01	0.3	0.1	<0.010	<0.003	3.1	9.4	<0.009
18/12	72	0.003	0.002	12.20	2.90	<0.1	<0.009	0.05	0.7	0.8	0.051	<0.003	11.3	13.9	<0.009
22/12	45	0.001	0.002	4.20	1.10	<0.1	<0.009	<.01	0.4	0.1	0.014	<0.003	10.6	9.4	<0.009
28/12	31	0.001	0.001	2.80	0.90	<0.1	<0.009	<.01	<0.2	0.1	<0.010	<0.003	8.0	8.6	<0.009

STATION 15015 VICTORIA HOSPITAL ENERGY FROM WASTE PLANT

TABLE: A3

TOTAL SUSPENDED PARTICULATES IN UNITS OF UG/ M3

DATE 1986	TOTAL TSP	TOTAL ANTIMONY	TOTAL CADMIUM	TOTAL CARBON	ELEMENTAL CARBON	CARBON CARBONATE	TOTAL CHROMIUM	TOTAL COPPER	TOTAL IRON	TOTAL LEAD	TOTAL MANGANESE	TOTAL NICKEL	TOTAL NITRATES	SULPHATE	TOTAL VANADIUM
26/05	46	0.001	<0.001	6.40	1.20	0.8	0.011	0.07	0.5	0.1	0.027	<0.003	3.4	5.7	<0.009
01/06	66	0.001	<0.001	8.00	1.20	0.6	<0.009	0.07	0.7	0.1	0.025	<0.003	4.7	7.4	<0.009
19/06	41	0.001	<0.001	4.90	1.40	0.1	0.011	0.05	0.5	0.1	0.019	<0.003	5.6	6.9	<0.009
25/06	22	0.001	<0.001	3.60	1.40	0.6	<0.009	0.03	0.4	0.1	<0.010	0.008	1.8	2.6	<0.009
01/07	37	0.001	<0.001	4.70	0.30	0.5	<0.009	0.02	0.3	0.1	0.012	<0.003	4.8	8.0	<0.009
07/07	90	0.001	<0.001	8.10	0.80	0.7	<0.009	0.04	1.6	0.1	0.041	<0.003	3.9	8.7	<0.009
13/07	25	0.001	<0.001	4.30	0.10	0.2	<0.009	0.03	<0.2	<0.1	<0.010	<0.003	3.4	6.3	<0.009
19/07	37	0.001	<0.001	5.20	0.10	0.3	<0.009	0.06	0.3	0.1	0.014	<0.003	4.1	7.8	<0.009
25/07	61	0.001	0.002	5.30	0.30	0.2	<0.009	0.06	0.5	0.1	0.027	<0.003	1.1	23.4	<0.009
31/07	41	0.001	<0.001	6.80	0.80	0.9	<0.009	0.08	0.8	0.1	0.019	0.019	2.0	3.6	<0.009
06/08	54	0.001	<0.001	7.30	1.70	<0.1	<0.009	0.05	0.4	0.1	0.015	<0.003	7.1	12.0	<0.009
12/08	40	0.001	<0.001	5.40	0.80	0.9	<0.009	0.05	0.5	0.4	0.033	<0.003	1.9	4.9	<0.009
18/08	33	<0.001	<0.001	6.40	0.50	0.4	<0.009	0.04	0.5	0.4	0.029	<0.003	1.4	4.3	<0.009
24/08	14	0.001	<0.001	2.90	0.40	0.1	<0.009	0.03	<0.2	0.1	<0.010	<0.003	0.9	2.1	<0.009
30/08	80	0.001	<0.001	4.70	0.70	0.1	<0.009	0.04	0.6	0.4	0.029	<0.003	4.6	7.4	<0.009
05/09	48	<0.001	<0.001	6.20	1.00	0.6	<0.009	0.03	0.6	0.1	0.011	0.004	1.9	4.6	<0.009
11/09	29	<0.001	<0.001	4.20	1.00	<0.1	<0.009	0.05	<0.2	<0.1	<0.010	<0.003	1.7	11.4	<0.009
17/09	20	0.001	<0.001	3.10	0.70	<0.1	<0.009	0.01	<0.2	0.1	<0.010	<0.003	1.9	7.1	<0.009
23/09	27	0.001	<0.001	4.20	0.90	0.1	<0.009	<0.01	<0.2	0.1	<0.010	<0.003	2.0	7.1	<0.009
29/09	36	0.001	<0.001	6.60	0.60	<0.1	<0.009	<0.01	0.2	0.1	<0.010	<0.003	3.6	10.9	<0.009
05/10	13	<0.001	<0.001	2.20	0.10	<0.1	<0.009	<0.01	<0.2	<0.1	<0.010	<0.003	0.9	4.3	<0.009
11/10	36	0.001	<0.001	4.00	1.00	<0.1	<0.009	<0.01	0.4	0.1	0.016	<0.003	3.4	6.6	<0.009
17/10	32	0.001	<0.001	5.30	0.90	0.2	<0.009	<0.01	0.3	0.2	0.024	<0.003	5.1	4.3	<0.009
23/10	53	0.001	<0.001	6.90	1.30	<0.1	<0.009	<0.01	0.6	0.1	0.036	<0.003	6.1	8.3	<0.009
29/10	33	0.001	<0.001	4.20	1.20	<0.1	<0.009	<0.01	<0.2	0.1	0.016	<0.003	4.9	8.0	<0.009
04/11	27	0.001	<0.001	3.40	0.30	0.2	<0.009	<0.01	<0.2	0.1	<0.010	<0.003	2.3	6.6	<0.009
10/11	28	<0.001	<0.001	3.60	0.30	0.2	<0.009	<0.01	<0.2	0.1	<0.010	<0.003	1.9	5.5	<0.009
16/11	40	0.001	<0.001	3.70	0.40	<0.1	<0.009	<0.01	<0.2	<0.1	<0.010	<0.003	8.0	11.4	<0.009
22/11	35	0.001	<0.001	4.00	0.50	<0.1	<0.009	<0.01	<0.2	0.1	<0.010	<0.003	7.7	11.0	<0.009
04/12	19	<0.001	0.001	1.20	1.00	<0.1	<0.009	<0.01	<0.2	<0.1	<0.010	<0.003	3.7	10.7	<0.009
10/12	31	<0.001	0.001	3.40	0.90	0.4	<0.009	<0.01	<0.2	0.1	<0.010	<0.003	3.4	8.3	<0.009
18/12	70	0.003	0.003	11.80	2.30	<0.1	<0.009	0.02	0.7	0.4	0.036	<0.003	11.7	14.3	<0.009
22/12	36	0.001	0.002	3.80	1.00	<0.1	<0.009	<0.01	0.3	0.1	0.012	<0.003	10.4	10.1	<0.009
28/12	26	<0.001	<0.001	1.80	0.70	<0.1	<0.009	<0.01	<0.2	<0.1	<0.010	<0.003	6.9	8.3	<0.009

TABLE: A3

STATION 15016 VICTORIA HOSPITAL ENERGY FROM WASTE PLANT

TOTAL SUSENDED PARTICULATES IN UNITS OF UG/M3

DATE 1986	TOTAL TSP	TOTAL ANTIMONY	TOTAL CADMIUM	TOTAL CARBON	ELEMENTAL CARBON	CARBON CARBONATE	TOTAL CHROMIUM	TOTAL COPPER	TOTAL IRON	TOTAL LEAD	TOTAL MANGANESE	TOTAL NICKEL	TOTAL NITRATES	SULPHATE	TOTAL VANADIUM
26/05	46	0.001	<0.001	5.00	0.60	0.7	<0.009	0.06	0.6	0.1	0.024	<0.003	4.4	8.9	<0.009
01/06	60	0.001	<0.001	7.90	1.40	0.6	<0.009	0.04	0.7	0.1	0.025	<0.003	1.7	7.3	<0.009
19/06	41	0.001	0.002	4.70	1.00	0.1	<0.009	0.05	0.4	0.1	0.021	<0.003	6.1	8.9	<0.009
25/06	22	<0.001	<0.001	3.10	0.20	0.4	<0.009	0.03	0.3	0.1	<0.010	<0.003	0.7	3.7	0.010
01/07	36	0.002	<0.001	4.20	0.10	0.1	<0.009	0.04	0.4	0.1	0.021	<0.003	4.7	8.0	0.017
07/07	66	0.001	<0.001	5.90	0.50	0.2	<0.009	0.04	1.4	0.1	0.046	<0.003	4.1	10.6	0.010
13/07	29	0.001	<0.001	4.20	0.10	<.1	<0.009	0.02	<0.2	<0.1	0.011	<0.003	3.2	5.9	<0.009
19/07	35	0.001	<0.001	4.90	0.30	0.1	<0.009	0.06	<0.2	0.1	0.013	<0.003	4.3	7.4	<0.009
25/07	62	0.001	<0.001	5.70	0.30	<.1	<0.009	0.05	0.3	0.1	0.025	<0.003	2.0	25.2	<0.009
31/07	34	0.001	<0.001	6.70	0.70	0.7	<0.009	0.09	0.5	0.1	0.014	0.007	2.1	3.7	<0.009
06/08	80	0.001	<0.001	10.80	1.00	1.6	0.009	0.06	0.6	0.4	0.026	<0.003	7.1	11.4	<0.009
12/08	36	0.001	<0.001	5.50	0.90	1.2	<0.009	0.08	0.7	0.3	0.031	<0.003	1.9	4.9	<0.009
18/08	34	<0.001	<0.001	7.20	0.30	0.6	<0.009	0.47	0.3	0.1	0.011	<0.003	1.6	4.3	<0.009
24/08	11	<0.001	<0.001	2.80	0.10	0.1	<0.009	0.29	<0.2	<0.1	<0.010	<0.003	0.9	2.1	<0.009
30/08	35	<0.001	<0.001	5.30	0.70	0.1	<0.009	0.41	<0.2	<0.1	<0.010	<0.003	4.7	7.6	0.011
05/09	32	<0.001	<0.001	6.10	0.80	0.1	<0.009	0.01	0.3	0.1	<0.010	<0.003	1.9	4.4	<0.009
11/09	29	<0.001	<0.001	4.60	0.60	<.1	<0.009	0.02	<0.2	<0.1	<0.010	<0.003	1.7	11.4	<0.009
17/09	22	<0.001	<0.001	2.80	0.90	<.1	<0.009	0.01	<0.2	0.1	<0.010	<0.003	2.0	6.3	<0.009
23/09	48	0.001	<0.001	5.10	1.00	<.1	<0.009	0.02	<0.2	0.1	<0.010	<0.003	4.9	16.3	<0.009
29/09	37	0.001	<0.001	6.70	0.50	<.1	<0.009	0.01	<0.2	0.1	<0.010	<0.003	5.1	10.6	<0.009
05/10	16	<0.001	<0.001	2.00	0.30	<.1	<0.009	<0.01	<0.2	<0.1	<0.010	<0.003	0.9	4.3	<0.009
11/10	31	0.003	<0.001	5.10	0.50	<.1	<0.009	0.01	0.3	0.1	0.018	<0.003	3.3	5.0	0.009
17/10	38	0.001	<0.001	4.70	0.90	0.3	<0.009	0.03	0.5	0.2	0.015	0.015	5.1	4.3	<0.009
23/10	48	0.001	<0.001	6.20	0.80	<.1	<0.009	0.01	0.5	0.1	0.013	0.004	5.4	8.6	<0.009
29/10	33	0.001	<0.001	4.40	0.60	<.1	<0.009	<0.01	<0.2	0.1	<0.010	<0.003	4.9	7.7	<0.009
04/11	28	<0.001	0.001	3.40	0.40	0.5	<0.009	0.01	0.3	0.1	<0.010	<0.003	2.0	6.7	<0.009
10/11	23	<0.001	<0.001	3.00	0.30	0.2	<0.009	<0.01	<0.2	0.1	<0.010	<0.003	<0.0	0.3	<0.009
16/11	43	0.001	0.001	4.50	0.60	<.1	<0.009	<0.01	0.3	0.1	<0.010	<0.003	<0.0	1.1	<0.009
22/11	40	0.001	0.001	4.90	0.40	<.1	<0.009	0.01	<0.2	0.1	<0.010	<0.003	1.8	5.3	<0.009
04/12	18	<0.001	0.001	1.60	0.60	<.1	<0.009	<0.01	<0.2	<0.1	<0.010	<0.003	2.6	7.3	<0.009
10/12	61	<0.001	<0.001	5.50	0.80	2.7	<0.009	<0.01	0.4	0.1	0.020	<0.003	3.4	8.0	<0.009
18/12	70	0.001	0.003	12.00	2.50	<.1	<0.009	0.03	0.7	0.4	0.035	<0.003	12.3	13.1	0.015
22/12	69	0.003	0.002	6.90	1.20	2.0	<0.009	<0.01	0.4	0.1	0.018	<0.003	11.3	9.6	<0.009
28/12	49	<0.001	<0.001	4.30	1.00	1.6	<0.009	<0.01	<0.2	<0.1	<0.010	<0.003	8.6	8.9	<0.009

STATION 15017 VICTORIA HOSPITAL ENERGY FROM WASTE PLANT

TABLE: A3

TOTAL SUSPENDED PARTICULATES IN UNITS OF UG/M3

DATE 1986	TOTAL TSP	TOTAL ANTIMONY	TOTAL CADMIUM	TOTAL CARBON	ELEMENTAL CARBON	CARBON CARBONATE	TOTAL CHROMIUM	TOTAL COPPER	TOTAL IRON	TOTAL LEAD	TOTAL MANGANESE	TOTAL NICKEL	TOTAL NITRATES	SULPHATE	TOTAL VANADIUM
26/05	66	0.001	0.005	9.30	0.90	1.1	0.018	0.11	0.6	0.2	0.031	<0.003	7.3	18.6	<0.009
01/06	76	0.001	<0.001	9.10	0.30	0.6	<0.009	0.04	0.2	<0.1	<0.010	<0.003	5.1	9.6	0.011
19/06	49	0.001	<0.001	5.50	1.20	0.1	<0.009	0.06	0.4	0.2	0.016	<0.003	6.6	9.7	<0.009
25/06	26	<0.001	<0.001	3.70	0.10	0.5	<0.009	0.06	<0.2	0.1	<0.010	<0.003	1.0	3.4	<0.009
01/07	44	0.001	<0.001	6.20	0.50	0.2	<0.009	0.06	0.6	0.1	0.017	<0.003	5.4	8.2	0.047
07/07	71	0.001	<0.001	7.00	0.30	0.2	<0.009	0.07	1.7	0.1	0.037	<0.003	3.6	11.7	<0.009
19/07	42	0.006	<0.001	7.00	0.40	<0.1	<0.009	0.07	0.3	0.1	<0.010	<0.003	6.0	7.2	0.024
25/07	75	0.001	<0.001	6.80	0.90	<0.1	<0.009	0.04	0.6	0.1	0.019	<0.003	1.7	28.0	<0.009
31/07	41	0.001	<0.001	9.10	1.00	0.8	<0.009	0.08	0.4	0.2	0.015	<0.003	2.3	3.6	0.032
06/08	59	0.001	<0.001	8.10	1.20	0.1	<0.009	0.32	0.3	<0.1	<0.010	<0.003	7.1	12.4	0.012
12/08	36	0.001	<0.001	6.20	1.00	0.5	0.012	0.19	0.3	<0.1	<0.010	<0.003	3.4	5.4	<0.009
18/08	41	0.001	<0.001	7.10	0.90	0.7	<0.009	0.11	0.4	<0.1	0.013	<0.003	2.2	5.7	<0.009
24/08	18	<0.001	<0.001	3.30	0.60	0.1	<0.009	<0.01	<0.2	<0.1	<0.010	<0.003	0.7	2.4	<0.009
30/08	44	0.001	<0.001	7.40	1.20	0.3	<0.009	0.05	0.4	0.2	0.023	<0.003	3.9	7.5	<0.009
05/09	54	<0.001	<0.001	8.10	0.90	0.9	<0.009	0.05	0.5	0.1	0.011	<0.003	2.0	4.6	<0.009
11/09	33	<0.001	<0.001	4.90	1.70	<0.1	<0.009	0.02	<0.2	<0.1	<0.010	<0.003	1.9	12.6	<0.009
17/09	32	<0.001	<0.001	5.50	0.50	0.3	<0.009	0.03	0.2	0.2	0.011	<0.003	1.9	6.0	<0.009
23/09	25	<0.001	<0.001	3.60	0.60	<0.1	<0.009	0.04	<0.2	0.1	<0.010	<0.003	1.6	6.0	<0.009
29/09	40	0.001	<0.001	6.60	1.50	<0.1	<0.009	0.03	<0.2	0.1	<0.010	<0.003	4.0	10.6	0.010
05/10	18	<0.001	<0.001	3.50	0.30	<0.1	0.011	0.05	<0.2	<0.1	<0.010	<0.003	0.9	4.4	<0.009
11/10	42	0.001	<0.001	5.90	1.40	0.1	<0.009	0.03	0.4	0.2	0.021	<0.003	4.1	7.7	<0.009
17/10	41	0.001	<0.001	6.60	1.10	0.2	<0.009	0.05	0.3	0.2	0.028	<0.003	6.9	5.9	<0.009
23/10	54	0.001	<0.001	7.50	1.60	<0.1	<0.009	0.04	0.5	0.1	0.024	<0.003	6.6	10.4	<0.009
29/10	34	0.001	<0.001	4.90	0.70	<0.1	<0.009	0.02	<0.2	0.1	<0.010	<0.003	5.3	8.6	<0.009
04/11	30	<0.001	0.001	4.20	0.60	0.3	<0.009	0.03	0.3	0.1	<0.010	<0.003	7.4	9.7	<0.009
10/11	40	<0.001	<0.001	4.50	0.50	0.7	<0.009	0.03	0.3	0.1	0.012	<0.003	5.6	9.7	<0.009
16/11	38	0.001	0.001	3.90	0.90	<0.1	<0.009	0.03	<0.2	0.1	<0.010	<0.003	2.0	6.1	<0.009
22/11	32	0.001	0.001	4.20	1.00	<0.1	<0.009	0.03	<0.2	0.1	<0.010	<0.003	2.0	5.3	<0.009
04/12	22	<0.001	<0.001	1.40	0.90	<0.1	<0.009	0.01	<0.2	<0.1	<0.010	<0.003	2.0	6.9	<0.009
10/12	41	<0.001	<0.001	4.10	1.60	0.1	<0.009	0.01	<0.2	0.1	<0.010	<0.003	3.4	9.5	<0.009
18/12	65	0.003	0.002	11.40	2.90	<0.1	<0.009	0.03	0.7	0.4	0.058	<0.003	11.4	13.1	0.012
22/12	44	0.001	0.001	4.80	1.40	<0.1	<0.009	0.02	0.3	0.1	0.011	<0.003	10.0	9.0	<0.009
28/12	28	<0.001	<0.001	2.80	0.90	<0.1	<0.009	0.01	<0.2	<0.1	<0.010	<0.003	6.9	8.6	0.009

Table A4 Comparison of Data for Glass Fibre and Polyfon Filters at Station 15015. Concentration in ug/m^3/24 hours

Parameter	Sept 23/86		Sept 29/86		Oct 5/86		Oct 11/86		Oct 17/86	
Filter Type	glass fibre	polyfon	glass fibre	polyfon	glass fibre	polyfon	glass fibre	polyfon	glass fibre	polyfon
Total Suspended Particulate	27	23	36		13	12	36	28	32	33
Iron	< 0.2	0.3	0.2		< 0.2	< 0.1	0.4	0.4	0.3	0.4
Manganese	< 0.010	0.014	< 0.010		< 0.010	< 0.005	0.016	0.020	0.024	0.026
Cadmium	< 0.001	< 0.023	< 0.001		< 0.001	< 0.004	< 0.001	< 0.036	< 0.001	< 0.024
Chromium	< 0.009	< 0.002	< 0.009		< 0.009	< 0.001	< 0.009	< 0.005	< 0.009	< 0.005
Nickel	< 0.003	< 0.014	< 0.003		< 0.003	< 0.008	< 0.003	< 0.004	< 0.003	< 0.004
Lead	0.01	0.07	0.1		< 0.1	0.01	0.1	0.05	0.2	0.13
Copper	< 0.01	< 0.003	< 0.01		< 0.01	< 0.001	< 0.01	< 0.001	< 0.01	< 0.002
Vanadium	< 0.009	< 0.002	< 0.009		< 0.009	< 0.000	< 0.009	< 0.002	< 0.009	< 0.003
Antimony	0.001	0.0001	0.001		< 0.001	< 0.0001	0.001	0.0004	0.001	0.0003
Lithium		0.0001				0.0001		0.0004		0.0003
Beryllium		< 0.00001				< 0.00001		0.00001		0.00001
Tin		0.0002				0.0004		0.0008		0.0010
Cobalt	< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
Total Carbon	4.20		6.60		2.20		4.00		5.30	
Elemental Carbon	0.90		0.60		0.10		1.00		0.90	
Carbonate Carbon	0.1		< 0.1		< 0.1		< 0.1		0.2	
Nitrate	2.0		3.6		0.9		3.4		5.1	
Sulphate	7.1		10.9		4.3		6.6		4.3	
Sulphur		0.228				0.131		0.276		0.302
Calcium		1.080				0.263		0.857		1.590
Silicon		0.851				0.222		1.377		1.204
Zinc		0.019				0.009		0.035		0.042

< = Less Than

Note: Data invalid for polyfon filter on September 29 due to pump failure.

Table A5 Comparison of Data for Glass Fibre and Polyfon Filters at Station 15016. Concentration in ug/m^3/24 hours

Parameter	Sept 23/86		Sept 29/86		Oct 5/86		Oct 11/86		Oct 17/86	
Filter Type	glass fibre	polyfon	glass fibre	polyfon	glass fibre	polyfon	glass fibre	polyfon	glass fibre	polyfon
Total Suspended Particulate	48	19	37	28	16	13	31	28	38	33
Iron	<0.2	0.2	<0.2	0.2	<0.2	0.08	0.3	0.04	0.5	0.6
Manganese	<0.010	0.010	<0.010	0.009	<0.010	<0.003	0.18	0.017	0.015	0.027
Cadmium	<0.001	0.014	<0.001	<0.0	<0.001	<0.0	<0.001	<0.0	<0.001	<0.0
Chromium	<0.009	<0.002	<0.009	<0.0	<0.009	<0.0	<0.009	<0.003	<0.009	<0.003
Nickel	<0.003	<0.001	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.015	0.032
Lead	0.1	<0.1	0.1	0.1	<0.1	<0.1	0.1	0.1	0.2	0.1
Copper	0.02	<0.00	0.01	<0.01	<0.01	<0.00	0.01	0.01	0.03	0.03
Vanadium	<0.009	<0.001	<0.009	<0.003	<0.009	<0.000	0.009	0.005	<0.009	0.003
Antimony	0.001	0.001	0.001	0.0004	<0.001	0.0001	0.003	0.0013	0.001	0.0002
Lithium		0.002		0.0001		0.0010		0.0004		0.0003
Beryllium		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001
Tin		0.008		0.0005		0.0014		0.0006		0.0007
Cobalt	<0.01		<0.01		<0.01		<0.01		<0.01	
Total Carbon	5.10		6.70		2.00		5.10		4.7	
Elemental Carbon	1.00		0.50		0.30		0.50		0.90	
Carbonate Carbon	<0.1		<0.1		<0.1		<0.1		0.3	
Nitrate	4.9		5.1		0.9		3.3		5.1	
Sulphate	16.3		10.6		4.3		5.0		4.3	
Sulphur		0.228		0.483		0.132		0.272		0.321
Calcium		0.914		0.390		0.359		0.934		1.900
Silicon		0.729		0.719		0.299		1.474		1.451
Zinc		0.012		0.018		0.003		0.025		0.039

< = Less Than